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Scientists Have Reported a Breakthrough In Understanding Whale Language

Researchers have identified new elements of whale vocalizations that they propose are analogous to human speech, including vowels and pitch.



By [Jordan Pearson](#)

December 7, 2023, 3:19pm



IMAGE:
REINHARD DIRSCHERL VIA GETTY IMAGES

Researchers have identified previously unknown elements of whale vocalizations that may be analogous to human speech, a new study reports.

Sperm whales are giants of the deep, with healthy adults having no known predators. Scientists studying their vocalizations have already picked out key elements of their communication, namely clicks, sequences of which are called codas. Now, researchers led by Gašper Beuš from the University of California, Berkeley report the discovery that the acoustic properties of



ABSTRACT breaks down mind-bending scientific research, future tech, new

unique “coda vowels” that are “actively exchanged” in conversation between whales, which they term the a-vowel and i-vowel.

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The researchers explain in their paper, [published as a preprint online this week](#), that the first clue that so-called spectral properties could be meaningful for whale speech was provided by AI. Beuš [previously developed a deep learning model](#) for human language called fiwGAN which “was trained to imitate sperm whale codas and embed information into these vocalizations.” Not only did the AI predict elements of whale vocalizations already thought to be meaningful, such as clicks, but it also singled out acoustic properties.

To follow up on the AI’s tip, the researchers analyzed a dataset of 3948 sperm whale codas recorded with hydrophones placed directly on whales between 2014 and 2018. They only analyzed one channel from the hydrophones to control for underwater effects and whale movement, and removed click timing from their visualization to better isolate patterns in the acoustic properties themselves.

These visualizations vindicated the AI’s prediction: The whales reliably exchanged codas with one or two formants—frequency peaks in the sound wave—below the 10kHz range. The researchers termed these codas “vowels,” with single-formant codas being a-vowels and two-formant codas being i-vowels. “This is by analogy to human vowels which differ in their formant frequencies,” the authors wrote. They also identified upward and downward frequency “trajectories” in these codas, which they considered analogous to diphthongs in human language.

“Under our proposed view, whale clicks are equivalent to the pulses of vocal folds in human speech production,” the authors wrote. “In other words, we treat clicks as the source and the sperm whales’ resonant body (the nasal complex, including the spermaceti organ) as the filter that modulates resonant frequencies.”

The analogies to human speech are readily apparent. The authors note, for example, that vocal tone in Mandarin can change the meaning of otherwise identical syllables.

“If our findings are correct, it means that the communication of sperm whales is much more complex and can carry more information than previously thought,” the researchers concluded.

TAGGED: [WHALE](#), [ANIMALS](#), [NATURE](#), [SCIENCE](#), [LANGUAGE](#), [ABSTRACT](#)

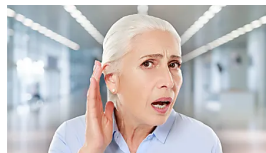
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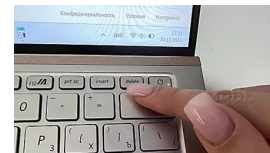
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